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We proceed now Gentlemen to enquire into the phenom
=ina and causes of Animal Heat. In doing so I shall
first mention the phenomena of animal heat as they
occur in the human body, and then mention the different
causes to which it has been ascribed. 1st It is the same
in all climates and seasons. This has been proved by
many experiments. Its medium temperature in the human
body is 98°. It is from 100. to 103 in certain domestic an
=imals. as in the Ox and Sheep. and it from 103. to 107
in certain birds. So uniform is the heat of the hu
=man body in all climates. That Dr Lining tells us
while the Mercury rose to 120° in S. Carolina. it fell
to 97° when breathed upon or placed in the arm pits.
In the West Indies Dr McKittrick says the heat of the
human body rides to 100° but this is probably from
a feverishness excited in the system by the heat of the
sun. or this extra heat may have been confined only
to the skin. This equable temperature of the body is seen
~~to characterize animal life~~ animal life, 2nd It is nearly
the same in all ages. in young children it is sometime
a grade or two above what it is in adult life. and

hence they are less affected with the cold than perso.
in middle life; There is something analogous to this
in other animals; the ova of insects resist cold more than
the insects themselves, and an insect in its Chrysolis
more than in its perfect state; The heat of the body in
old age is less than in early and adult life.

3rd It is the same in both sexes under equal circumstances
It is true men resist cold better than women, but this
is owing to the powers which produce heat in the male
acting with more force than in the female sex.

4th It is nearly the same in every part of the body. when
it is in a healthy state; It is one degree greater in the
lungs and near the heart, than in other parts of the
body.

Mr Hunters Experiments show it to be as follows in
different parts of the body. On the Skin 97.8, under
the tongue 97, In the Urethra, one inch, 92. In the
rectum 93½. Schwenke says it is less in the blood in
the veins, than in the arteries; This if true, may be accoun
-ted for by a cause to be mentioned presently. It is more
permanent and perhaps greater in the head.

5th It is the same in the solids and fluids of the body

6th It is increased by exercise, and the stimulating
passions of the mind.

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7th It is according to J. Hunter, one degree less in the sleeping than in the waking state; But according to Dr Darwin, one degree greater in the former, than in the latter state, both apertions may be true. In falling asleep, we wake suddenly with a sense of cold — but heat increases with sleep — hence we awake in the morning with a sense of warmth, and often with a moisture from it upon our skins. May not this increase of heat possibly be owing to the disease of Sleep.?

8th In certain diseases several of the phaenomena which have been Mentioned cease to take place. 1st It is unequally distributed upon the surface of the body. 2nd in the viscera. 3rd in the solids and fluids. 4th It is above 98.° and 5th It is below it.

I shall now enquire into the causes of the phaenomena of animal heat which have been Mentioned. I shall begin by remarking that there are several modes of exciting heat out of the body. These are, combustion, pressure, friction, percussion whether by a single or successive strokes, fermentation and electricity, the three former, and perhaps the two latter, may all concur in the production of animal heat.

Combustion was supposed for a long

time to be occasioned by the discharge of a princi-
=ple called Phlogiston. by ✒ means of the action of
air upon it. This phlogiston is supposed to be the
same in all bodies, and transferible from one
body to another.— But the experiments of Lavoi-
=sier, and of other french Chemists, have called in
question the existence of this supposed principle of
phlogiston. They say that the principle which pro
-duces combustion does not reside in the burning body,
but in the air which acts upon it. The air they say
is a compound body consisting of 27 parts of a
matter they call oxygen, 72 of what they call azote,
and one of carbonic acid. The oxygen they say pur
: ther is a compound of pure air, and a substance they
call calorie, that is the matter or principle of heat,
These facts being admitted, combustion they say is
occasioned in the following manner: The body to
be inflamed, being first heated, the air rushes upon
it and undergoes a decomposition. The pure air is
absorbed by the burning body, and the calorie is set
at liberty, and hence the production of light and heat.
the air which is unconsumed, is rendered unfit

to support ~~fire~~ any longer. It even extinguishes flame.
It is in this State called phlogisticated, or azotic air.
Exactly the same procss Dr Black has supposed
takes place in the production of animal heat. We
all carry a fire place about with us. and the
chimney which contains it. is seated the Dr
supposes in the lungs. The Facts which support
this opinion are as follows.

1st The absolute necesity of air to support animal life
there is no animal in the world that lives without
it. whether it exist in the air - in the water - under
the earth, - or upon the face of the earth. - Birds breathe
and lest they should suffer from an inability to
perform that function in their rapid flight through
the air. they are provided with cells, which serve
as reservoirs, of air, and which probably may af-
=ford them the oxygen. which supports their heat.
Even the bones of birds contain air. and possibly
for the purpose that has been mentioned. ———

Fishes respire air, by means of their gills. they
sicken and die when deprived of it. Their air
bladder may probably supply for a while the

want of external air, although the principal design of it is to assist them in ascending and descending in the water.

Insects which are destitute of lungs & gills do not live without air; it is conveyed to them by means of long tubes called Trachea or Tegumenta extending from different parts of the body. In some insects these tubes arise from the posterior, in others from the back and sides; if these tubes be stopped by means of oil, the insect dies from suffocation, that is from the want of air.

Worms likewise exist only in consequence of their communication with the air.

Snails die without air, when they retreat from the cold of winter, they cover their bodies with a slimy coat, so thin as to admit the passage of air through it. If this coat by any accident become too thick to admit the air, they perforate it in order to make a passage for it

The Toad which has been

found

found in the middle of the trunks of large trees, and in the centre of stones where it has existed for one or two centuries, it is generally supposed receives air enough to preserve its heat. through the pores of the trees. and the cavities of the stone.

Lastly, even those insects which are destitute of lungs have a membranous tube running along their backs in which dilatations and contractions may be distinctly seen, and to this tube the air has access.- Cuvier in speaking of this curious contrivance says. "the blood not being able to go in search of air; the air goes in search of the blood".

The heat in all these classes of animals is different. in the fish it is but 2° above the temperature of the water in which they swim. the heat generated is generally in proportion to the size of their lungs and the quantity of air consumed in them,

2nd. The Connection of the heat of the body with the admission of air into the lungs, has been inferred from the quantity of air consumed in respiration, said to be a gallon in a minute - that is, 14 cubic inches in each inspiration, but according to Dr Jurin, and Dr Menzies experiments 40 cubic inches, in a minute in a heat of 60°. It is said to expand to 43 cubic inches in the lungs.

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3.rd The connection of the heat of the body with the admission of air into the lungs. has been admitted from animal heat being in proportion to the quantity of air consumed in respiration, and to the relation of the size of the lungs to the size of the animals, It is 111° in birds, and they we know have larger lungs in proportion than any other animals, animal heat is in a lower degree in fish. insects and reptiles, than in man. and many other breathing animals. and they we know have very small lungs in proportion to their size, and consume but little air in respiration. It is in a very low degree in the toad. for which reason Mr Twigs informs us in his travels into Spain. that the Spanish ladies sometimes carry toads in their bosoms in order to lessen the heat of their bodies in hot weather.

4th From the change which takes place in the air which is discharged from the lungs in expiration being exactly the same as that which is produced in the air after it is robbed of its caloric or matter of heat by the combustion of a peice of wood or any other body: The air we expire is true azote or phlogisticated air, and not only extinguishes flame but is fatal to animals that breathe it.

5th From the azotic air which is

discharged from the lungs being less warm ~~than~~ accor
=ding to Dr Crawford, than pure air which is taken into
the lungs.

6th From the arterial blood on which the oxygen air first
acts, being warmer by one degree and ½ according to Dr.
Crawford. than venous blood.
According to Mr Hunters anatomical thermometer it was
99° in the right ventricle of the heart, and 97° in the left
ventricle of a dog hung for the purpose of ascertaining
this fact by Mr Coleman.

7th From the red color of the blood. This color we know is
derived from oxygen in the Colcothar of vitriol, in red
lead, and in hams preserved with salt petre, which salt
abounds with oxygen. Now the red color of the blood is
supposed to be derived in like manner from the action
of air upon it in the lungs. It is certainly much redder
in the pulmonary vein than in the pulmonary arte
=ry after the air has acted upon it. and much redder
in an adult than in a fœtus which has never breath
=ed

8th from the analogous effects of oxygen air upon
a burning body, and upon the lungs, the more of
this air that can be applied to a burning body,
the more vivid is the flame emitted by it, and

the greater is its heat. in like manner the more of this air that is received into the lungs, the greater the generation of heat, and hence the encreased heat of the body in a fever, and after exercise.

Simple and beautyful as this theory appears to be, there are several solid objections to its being the sole or exclusive cause of Animal heat. I shall briefly mention these objections.

1st the heat of the body has been observed to be the same when the admission of air into the lungs has been prevented by disease or apparent death. a case of the latter kind is mentioned by De Haen; a case occured in Philad[a] on July 5th 1811. in a man, in whom there was a total extinction of life from drinking cold water when he was very warm, his whole head - hands, and trunk, were uncomonly ~~warm~~ hot four hours after his respiration was destroyed by death. Dr Fodere in his "Medicin legale" mentions a case in which the heat of the body continued four days after death had taken place.

2nd The heat of a limb is sometimes encreased after

the operation for aneurism, whereby the passage of the blood which has been supposed to convey the heat gen=erated in the lungs. to every part of the body, is com=pletely obstructed. I witnessed a remarkable case of this kind in June 1811. in J Hosey, a patient of Dr Physick. the heat was much greater in the limb on which the operation had been performed, than in its fellow: and it was so long before it was possible for the anastomozing vessels to supply the function of the large artery that had recently been tied up and divided, and that had just before conveyed a stream of blood to the limb. I ask in this case whence did the limb recieve its extra quantity of heat.

3.rd The heat of the body is often independant of the frequency of the pulse, or the force, or the quantity of blood propelled into every part of it. we observe the skin to be very hot when the pulse is at 40. and I think the hottest skin I ever felt was in a Sailor in the yellow fever, in whom the pulse was imperceptible at both his wrists

4th The heat of the body is demenished in old age.

and yet old people inhale and consume as much air as they did in early and middle life.

5.th There is sometimes a stoppage of respiration without any diminution of heat. Thus we see children hold their breath in crying, and yet the heat of their bodies continues the same. The horse it is said in a race of 400 yards holds his breath, and yet the heat of his body so far from being lessened. is greatly encreased. He pants it is said only at the end of the race — and never in his course — 6.th There is often a partial and morbid cessation of heat in the extremities, while the parts between them and the lungs are cool, or cold, This could not be the case if the lungs were the only and exclusive source of the heat of the body -

7.th The heat of the body is but one degree greater in the lungs. than in parts more remote from them. Now. were the lungs the sole place in which the heat of the body was exclusively generated. it ought to be more than one degree greater than in the extremities.

8.th Certain aliments and drinks encrease the heat of the body. without acting in the smallest

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degree upon respiration, or encreasing the decom
-position of air in the lungs.

9th Certain sounds encrease the heat of the body. This
has often been experienced after the firing of cannon.
Now in this case no additional decomposition of air
takes place in the lungs. for there is no encrease of
respiration.

10th Light encreases the heat of the body. This is often
experienced on a hot evening in summer when can
-dles are suddenly brot into a dark room. No one
can suppose that in this case more air to be taken
into the lungs, or a sudden decomposition of an encreased
quantity of air to have taken place in them.

11th Certain passions encrease the heat of the body without
the least influence upon respiration, or the decomposition
of air in the lungs.

I have attempted year after year to explain these facts
so as to reconcile them to the theory of my illustrious
Master Dr Black, but I never have been fully satis
-fied with the solutions of them. I am compelled there
=fore to reject the decomposition of air in the lungs as the
exclusive cause of animal heat, and to call in addi
=tional cause for that purpose, which I shall now

submit to your examination, I shall begin by delivering a few general propositions.

1st All bodies contain a certain portion of calorie, or matter of heat in them.

2nd These bodies are so constituted as to emit heat from impressions made upon them by means of friction and percussion. This is obvious in a piece of cold iron under the stroke of the hammer. It occurs likewise in wood, the protracted friction upon which, not only elicits heat, but induces flame. It is thus the Indians in this country kindle their fires. It takes place even upon compressions made upon air. and that to such a degree in an instrument called the "pheumatic bryquet" as to induce combustion in a substance known by the name of Punk.

3. Different substances possess a different degree of susceptibility to impressions, so that heat is elicited from them in a greater or less force. and the heat is encreased according to the greater or less duration of those impressions. These facts being admitted, I proceed to apply them by remarking.

1st That animalized matter in common with the substances that have been mentioned, contains a quantity of Calorie, or matter of heat in it, which it emits

in common with those substances, in consequence of impressions made upon the body, and thus produces the sensation and other phaenomena of animal heat

In addition to the facts that have been mentioned of the production of heat from aliments, sounds, light, and the action of the passions upon the body. I shall mention two facts from Dr Peart. The hand of a man in good health was placed in a bason of water at the temperature of 50°. while his hand was quiescent the heat of the water rose to 55°. (that is, 5°. but when he moved his hand and fingers in the water it rose to 73°. (that is. 17°). Again he placed the hand in a bason of water. at 57°. in this situation he filled all its muscles by an act of the will. without moving his hand. The water rose in this case 5°. beyond its temperature in the quiescent state. Here we see heat produced as in the "pneumatic bri-quet" by simple pressure. Who after the results of these experiments can suppose animal heat to be the effect of respiration only. or the decomposition of air in the lungs.

It would seem from all the facts that have been mentioned. that a portion of animal heat

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like animal life, is the product of stimuli acting upon different parts of the body.

Let us enquire how far the theory I have delivered accords with the phaenomena of animal heat in the healthy and diseased body, and how it is applicable to the practice of physic, or the cure of diseases.

1st Is warm air a Stimulus.? We find the heat of the external parts of the body encreased by its action upon them

2nd are aliments & drinks when taken into the stomach of a stimulating nature.? We distinctly observe the heat of the body to be encreased by them. This is most observable after a full meal

3rd Do sounds, light, and odours, stimulate the senses.? We observe the heat of the body to be encreased by their action upon them.

4th Are certain exercises of the mind of a stimulating nature.? We find the heat of the body encreased by them. particularly by love, and anger.

5th are Frictions upon the body of a stimulating

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nature? we find the heat of the body encreased by them likewise

6th Do bleeding purging, ~~&c~~ vomits, and low diet, lessen the heat of the body. they appear to do so. by the abstraction of stimuli.

7th Does the body become cool, and even cold, from the operation of fear. and grief upon it.? May they not suppleant the action of the stimulating passions.?

8th Is the heat of the body encreased in certain diseases, particularly fevers,? It is because new stimuli called irritants act upon it, or because customary stimuli act with encreased force upon it from being rendered more excitable from the debility which preceeded the fever.

9th Is the <u>head</u> usually warmer in diseases than the other parts of the body?. This is so much the case that it is seldom cold even in the chilly fit of an intermittent. The reason of this, may be owing to the stimuli which act upon the Nerves, producing more impressions upon the brain. than upon other parts more remote from the Nerves.

10th Is the heat of the body diminished in chronic diseases.? May not the sentient extremities

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of the nerves have lost a portion of their sensibility to the action of stimuli?

11th Is the heat of the body lessened in old age? it is because every part of the system has become so torpid, as not to feel a sufficient degree of impression from stimuli, to produce the natural and usual emissions of heat.

There are several of the phenomena of heat in the human body that require a specific explanation.

1st We sometimes observe the heat of the body to be encreased after the abstraction of a portion of the stimuli which I have supposed to be the cause of it. I said formerly that the abstraction of any stimulus encreased the power of others in producing animal life. Why should not the same thing take place in the production of animal heat?

2nd. We observe the body to be cold in malignant fevers. While we are sure it is under the influence of the most powerful stimuli, particularly of heat and miasmata. In this case I suppose that quality in the body which disposes it to emit heat to be so over stimulated, that it cannot perform its ordinary functions. The other three attributes

the acuteness & talents which have been so frequently employ
-ed on the present subject, so much should remain to excite
the attention, employ the time, or reward the labours of the
diligent enquirer after truth. I do not imagine that I
shall arrive at any thing very useful or certain in the
present enquiry. I hope to be able only to point out some new
avenues to the more enlightened & better qualified traveller in
the paths of Science that may be useful to him on his journey,
or by suggesting some new hints on this most important subject,
shew that animal heat is not entirely derived either from a
mechanical or chemical source (as has been supposed) but is also
from a living or vital origin.

It will certainly be unnecessary to make many
animadversions on the mechanical Doctrines. That heat is not
owing to the "friction of the fluids against the solids of the body"
or to their motion on each other, has been rendered improbable

1. Because heat by friction is produced only in bodies that are
solid. Water may be agitated for ever without producing heat.
Now the blood we know is fluid.
2. "Heat by means of friction requires one of the bodies

to be fixed. No heat is produced by a rope and pulley. The blood & the vessels in which it circulates are, in like manner, both of them moved.

3. The impetus of the blood in any part of the body is too slow to occasion heat by friction.

To the chemical theory, & particularly to that of Dr. Crawford, the following objections may be urged:

1. An increased action of the heart & arteries, as well as of the Lungs, in particular diseases, frequently exists without any additional increase of heat. Now in these cases, if the theory of Crawford be true, the increased momen-tum of blood thro' the Lungs, & the additional quan-tity of oxygenous air to which that fluid is exposed ought surely to effect a manifest change in the quantity of animal heat.

2. In the two sexes, in childhood, in adult life, & in old age the heat of the human body is nearly equal, when material differences exist as well in the force & frequency of the pulse, as in the state of respiration.

3. Certain sounds, it is said, as well as certain aliments increase

the temperature of the body. But in these cases there is surely no additional decomposition of oxygenous air.

4. The phænomenon of horse racing, & other similar instances in which there is a partial stoppage of respiration shew no diminution in the heat of animal bodies.

5. Heat has been known to fluctuate in the body after apparent Death when the Lungs have been quiescent for several days.

6. In morbid states of the system the extremities are frequently warmer than the Lungs, (which are considered the chimney of animal heat) a circumstance which ought not to take place if the chemical theory were true.

7. & lastly. The passions of the mind have a wonderful influence over the heat of animal bodies – a circumstance which is of the utmost importance in the consideration of the present subject; & which has certainly been too much neglected by modern physiologists.

Independently, however, of the objections to the theory of Dr. Crawford which have been stated, together with others which will be occasionally introduced in the course of these

* Dr. John Redman Coxe.

remarks, they will receive additional force from considering a fact mentioned by some modern chemists on the present subject. From this it would appear that the oxygenous air taken into the Lungs during inspiration answers the very important purpose of combining with the carbon given off from the Lungs, converting it into carbonic acid gas, & thus preventing the fatal effects which would otherwise result from the bronchial vessels being clogged up by this accumulation of carbon. From this view of the subject it is plain to perceive that animal heat cannot be derived from the passage of an eriform body to one in a fluid state. On the contrary, Carbon (a solid substance) is converted into carbonic acid gas which would require an additional quantity of sensible caloric to be rendered latent to maintain it in its gaseous form; & should, if the principles of modern chemistry be true, produce the sensation of cold rather than that of heat.

The change of fluid blood into the solid muscular fibres being one of the causes of animal heat, as taught by a very ingenious & enlightened Chemist* of the present Day, is equally unsatisfactory. True it is that when a fluid body

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changes into a solid state it generally gives out the caloric which maintained its fluidity. But the science of modern Chemis-try teaches us to believe that, from the great rapidity with which caloric tends to an equilibrium, this change, in order to produce sensible heat, must be sudden; whereas the formation of blood in the animal solids, in an ordinary state of health, is gradual & slow. By this theory we are likewise ignorant of the source from whence the blood itself derives it heat. And the production of cold when our fluid Lakes & Rivers become solidified by the embrace of chilly winter must ever remain a forcible objection to the theory which has just been mentioned, during the present imperfect & fluctuating state of chemical Science.—

As to the statement given by the same writer that the blood contains more latent heat than other fluids of the body, & that in its change to various secretions it renders sensible some of ~~its~~ latent caloric, is certainly a mere opinion which it would be unphilosophical to admit until some proofs are offered in its support.

Sufficient, however, it is hoped has been stated to shew

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that our opinion of the mechanical & chemical theories of animal heat is not without foundation.

That animal heat is not altogether derived from a physical source, but, at least in part, from some other origin I shall endeavour to evince. But in order to concentrate our view of a subject so extensive as to embrace all animals, land as well as aquatic, how various & even diversified soever their natures may be; It is proposed to divide the subject into the following heads: viz

I. Of animal heat & its distinguishing properties.
II. Of physical heat & its properties.
III. Of the connection between animal & physical heat.
IV. Of the effects of this connection.
V. Of the subjects of the operation of animal heat.
VI. Of hot blooded animals.- &
VII. Of cold blooded animals.

To enter into a full discussion of these particulars would far transcend the limits usually allowed for inaugural dissertations;- & certainly trespass too long upon the time & patience of the enlightened personages to whom this

is submitted. We shall consequently very briefly consider the separate articles in the order proposed. &

II. Of animal Heat & its distinguishing properties.

Animal heat, we may remark, is inseparable from animal life, for where no life is, there no animal heat can be said to exist. But as this heat is made manifest to sensation, it follows that it is a derivative from, & not the life itself; for life is evidenced by its qualities or adjuncts only.

That life is Hot is manifest from its activity stim-ulating the affections, desires, & passions into fruition. & further, that such as the life is, such is the excitement & consequent action.

Without organization there can be no perfect Life, & consequently no animal Heat. Now organization implies formative science, & hence arises a plain distinction between solar & animal heat.

The blush of shame excited into the human cheek;- or the pallid hue of dismay; are equal proofs

of physical forms being under the control of a power very different from physical temperature as will presently be shewn.

Nor can it be assented to that the colour of the blood is altogether owing to physical operation, no more than its quantity, composition, or consistence; for if it were, it does not appear why the colour of the blood in all animals should not be the same.

We do not well see how it can be denied that animal heat is prior & within physical heat, when, in any given physical temperature, the passions of lust, anger, hatred or revenge can be excited into operation at the option of the will, altho' such passions were apparent-ly quiet a few minutes before.

In short, without an active animal life & heat, animated being would be mere automata.

III. Of physical heat & its properties.

We know of no other source of physical heat to this our orb than the Sun, the centre of the plan-etary system.

From him the revolving Earths derive the whole of their possessions.

Like himself are his operations. He is present, by his rays of heat & light, in every part, as well as in the whole. But as he does not possess life, neither can he give it: he approaches not the higher limits of animation. In this respect, his superior power at the equator is equally impotent as his feeble rays at the poles.

The general effects of heat, as Chemistry teaches, are expansion from centre to circumference, with elevation towards the centre by means of evaporation.

Heat combined with light gives colour according to the degree of mixture of each, as is exemplified in the flowers of the field, & in the grass of the Earth, & in most natural objects. In a different degree of combination,

as in sultry summer heats, it destroys not only colour but often the subject in which colour inheres.

Physical heat can be measured as to quantity, & even quality, by proper instruments; — but we know of no instruments whereby to ascertain the precise quantity or quality of animal heat.

We know that human bodies in health are commonly heated physically to about 96° of Farenheit's thermometer; but we are ignorant of any physical scale which shall give us the exact admeasurement of human passions — much less those of all animated nature.

Physical heat, like bodies of that class, is mere matter, & therefore subject to material laws, wherein it differs from the appetites & passions of organized life.

Animal heat, it was shewn, is inseparable from organized life; — whereas solar heat is found in most substances, organized or not, either in a latent, or in a sensible or sensatory state, & is dead.

This then constitutes a palpable difference between them.

We have said (II) that animal heat, as being an immediate derivative of Life, is prior & within physical heat; & this is manifest by animal action being an effect, and flowing into animal bodies from the internals of their beings. Hence it would appear an inversion of nature to attribute to solar heat, which is manifestly external to us, the property of communicating that which is internal;- It would be like putting the effect for the cause; or placing the cart before the horse.-

IIII. Of the connection between physical & animal heat.

Without an union of animal heat with solar influence there could be no animals in nature. For it would seem that the passions, appetites, and affections require what the painters express in regard to the fugitive colours of delicate vegetables - "They want embodying".-

To this union we are indebted for our knowledge

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of physiognomy; for our muscular power; for the lightning darting from the eye; & for many other things which we need not relate.

To this union, we imagine, the colour of the vital fluid, which circulates thro' our vessels, & like a flowing tide, wafts to the extremest limits its purple riches, is altogether owing.

It is indeed true that the blood is poured into the right auricle & ventricle of the heart dark; & even pushed into the Lungs from thence of the same hue; & that after it has received the pulmonary action it becomes florid; & is (thus changed) transmitted by the left ventricle to the general system;-yet it does not evidently follow from hence that either its colour, or its animation, is derived from this source.

If it were derived from oxygen, that fluid must previously contain it;-(which we believe has no where been shewn) & that the animation, (if such, as we suppose, be allowed to it) we have attempted to shew before arises from quite a different origin. —

IV. Of the effects of this connection.

The effects of uniting animal heat with that of the Sun as mentioned above, (IIII) in organized bodies, is embodying our affections & passions. This seems to be a primative or first effect, & from this all other effects in animated nature, apparently arise.

Thus while this union lasts, the senses are active in degree, & life endures; - whereas disunion dissolves the bodily bond & Clay-cold death ensues.

When parted, no solar influence, neither in quantity nor quality, can possibly restore the genial warmth which the living possessed - but dust it is, & to dust it must return. The better part is gone, & left the dregs behind. -

The blood, which in the living Man was supposed to owe its scarlet dye to vital air, or to some material cause, now lies torpid in the veins in black clots, insensible & unmoved by surrounding

objects, altho' in the very midst of those to which its active powers were said to be owing.

But if our attempt (II) be correct, in endeavouring to establish a distinction between animal & solar heat, then will the difficulty be solvable, & the knot untied; for as all heat is active, as well solar as animal, it follows that the central heat must be the most active of the two; - or must be as Master and Servant.

If this should really be the case, then there is more reason to suppose the original colour of the blood to depend chiefly on animal heat, & that it is modified by the heat & light of the atmosphere.

V. Of the subjects of the operation of animal heat.

All organized beings are subjects of its operation, for as life is active, & action cannot exist without heat, it would seem evidently to follow that heat proximately derived from life, must excite the organs into

their respective actions; & that this heat, thus derived, is clothed with physical heat as with a garment; — or as the hand of a workman is made effective by his hammer, so is the animal heat by the solar.

We find the chick in ovo is torpid without a determinate physical temperature, yet we cannot with any colour of truth say that solar or physical heat ~~heat~~ gives animation to it; nor are we to suppose that the crocodile or tortoise eggs are animated by a warm Sun, altho' deposited in a hot shore, whilst the prolific principle of either animal lodges within; but the contrary of this might, we imagine, without much difficulty be maintained.

VII. Of warm blooded animals.

All animals on our globe which breathe by means of Lungs only, are possessed, with trifling deviations according to thermometrical measurement, of a degree of physical heat equal to about 96°. The lowing herd in times of spring, — the ferocious quadruped of the african

* The physical heat of birds is 111°.

deserts, – & the feathered songster* of the grove that charms by its melodious lay; – nay, all the orders and Genera of the classes Mammalia & Aves, according to Linnaeus are equal proofs of our assertion. –

All these animals are said to be hot blooded.

Now that their appetites, affections, or passions are more ardent than in other classes of animated beings, daily experience as well as the recorded testimony of philosophers are calculated to evince.

Hence it follows, that their very existence is a proof of what we have stated above, (II) that such as the life is, such is the excitement & consequent action; – & consequently such as is the constitution of an animal, such is its vital or animal heat.

VII. Of cold blooded animals.

Whether it be the insect tenant of the air, – the creeping worm, – the amphibious Reptile, – or the finned inhabitant of the Ocean, they are all justly entitled

to this appellation.

It will not, we imagine, be denied that all fishes inhale by means of Gills the air of the waters in which they live: for if the air of a vessel containing them be abstracted by means of an air pump, they instantly die.

All insects we know inhale the oxygen of our atmosphere thro the medium of lateral spiracula.

The naturalist, moreover, teaches us to believe that Crocodiles, Tortoises, & Frogs do breathe oxygenous or vital air; — & yet we do not perceive either that fishes, insects, or reptiles, possess, under any circumstances whatever, the heat of human bodies; altho surrounded on every side by the very fluid from which pneumatic philosophers have supposed animal heat to be derived.

We have now briefly noticed our subject under the different heads originally proposed. It is surely not necessary to add more. But if it were admissible in

an attempt like this to call in collateral circumstan
-ces to our aid, the very terms of Language are expres
on this subject. Who is there that does not speak
of the warmth of affection; The flame of Love; the
fire of anger; burning or heated desires; together with
a hundred other similar expressions to be found in
all Languages both of ancient & modern times?

We may certainly then suppose that as heat
spreads from centre to circumference, there must needs
be an internal source of it. That affections are warm
no one can deny;- & that animal heat, therefore, does
not proceed from dead solar heat (which is external)
every one may perceive. —

Having thus brought this inaugural
dissertation to an end, it behoves us concisely to
recapitulate the contents as a conclusion from
the premises already laid down.

We imagine the following corollaries may
consistently be drawn:

1.

2.

3.

1. That animal heat is not matter but independent of it. —
2. That solar heat is matter, & definable by material Laws. &
3. That these two, by union, produce all the variety of existence we perceive throughout animated nature. —

Finis